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XIII.—*Further new Parasitic Copepods found on Fish in the Indo-tropical Region.* By P. W. BASSETT-SMITH, Staff-Surgeon R.N., F.Z.S., F.R.M.S.

[Plates III.-VI.]

DURING the past year, owing to H.M.S. 'Cossack' having visited a variety of harbours in the Indo-tropical region, the opportunity has been given me of adding considerably to what I had already seen at Bombay of these curious little parasites; continued research has shown very clearly that they are abundantly represented. In most cases, when inspecting any number of well-grown fish (for it is certainly more common to find the mature fish infested with one or more parasites than the younger ones), careful examination would bring to light some actively moving *Caligus* in the gill-cavity, or perhaps a more bizarre and anomalous form, attached to the lips, body, or elsewhere. One point has been very strongly impressed on my mind, namely the constancy with which most of them are found on any particular kind of fish; and one can predict with almost certainty the form that will be found, though at the same time it appears that one species may at times be taken on two or more distinct "hosts." As is only to be expected when the fish in this region are comparatively so little known, very few of these small parasites

have been described. I have therefore in this paper brought forward a few more of the best-marked forms, following "Gerstaecker's" classification, as before, having, however, to add to his genera a new one in the family Dichelesthiina.

It is very pleasing to be able to bring to light second species of two genera, both of which were created by Dr. Heller in 1865, my specimens having been obtained in localities considerably removed from that whence the original ones came; in the case of *Hermilius*, though the species differ, the genus of both host and parasite remains constant.

At present there are a large number of known species belonging to the genus *Caligus*, some of which have been described from single specimens, or even from the male alone; this should evidently be avoided as much as possible, for in different stages of growth they vary considerably in outward conformation, especially with regard to the shape of the genital segment; true differentiation can only be carried out by detailed examination of the articulate organs, maxillary and swimming-feet, &c. Since describing *C. hirsutus** many larger specimens of this species have been taken; in these the genital segment became broader and more winged, but the characteristic condition of the fourth peræopods is always present, as also the dilated appearance of the abdominal portion.

The work of collecting is difficult, for in a native market the crowds of moving, gesticulating, dirty, odoriferous men and women, though picturesque, render close inspection and examination of the fish almost impossible, besides the dislike the natives mostly have of a "saheb" touching anything they may want to eat; again, no doubt a large number of those parasites that live on the external surface get washed off before the fish are taken to the market.

Ergasilidæ.

BOMOLOCHUS, Nordm.

Bomolochus denticulatus, sp. n. (Pl. III. fig. 1.)

A series of specimens of this species were taken in small numbers at a time from the gill-cavities of a "Barracouda" (*Sphyræna jello*) from Trincomalee and Colombo, as well as from the gills of a "garfish" (*Hemirhamphus far*), also at Trincomalee, often together with a small *Caligus* not yet described.

* Ann. & Mag. Nat. Hist., Jan. 1898, p. 6.

This animal resembles very much *B. scomberesocis*, Kr., but after the examination of a number of specimens I believe it to be distinct, chiefly distinguished by the character of the "frontal processes" and the structure of the claws on the outside of the outer branches of the true legs, which here are strongly dentate, so markedly so that it appears impossible that "Krøyer" could have omitted to note the fact, especially as he makes such a point of the curious spur found at the end of each of these claws; the single specimen from which his description is taken was found in the tropical Atlantic, those of mine in the Indian Ocean and on different kinds of fish.

Female. — Body elongate. *Cephalothorax* five-partite; first segment much broader than long, convex above; third segment very globose in shape, projecting considerably dorsally as seen from the side (Pl. III. fig. 1 a). First segment rounded in front, giving off the frontal plates by narrow pedicles a short distance on each side of the middle line, where the frontal border is deeply cut out, presenting a fossa and a semilunar process as described by Krøyer*.

The *frontal plate* bears on each side on its anterior edge about fourteen delicately ciliated setæ; the inner two are large and curve over the central fossa, the outer three are longest and straight, directed outward; there are also from the upper surface three slender bristles, directed forward, placed nearly equidistant from one another, the outer being the shortest and most slender; on the dorsal surface on each side of the central fossa are two horny processes with strong muscular attachments, each bearing three very short obtuse-ended bristles of about equal length, pointing forward; these appear to be shorter and thicker than those of *B. scomberesocis*, Kr.

Anterior antennæ long, slender, three-jointed, minute hairs at the joints and a bunch at the end of the terminal joint.

Posterior antennæ biarticulate, each antenna folding on itself; the second joint is of peculiar structure, it terminates in two short crenate processes, between which are three small hairs; on the inner border is a tubercle with a strongly dentate surface, the whole inner face of the limb being covered with minute teeth. *Hamulus* placed laterally; it is two-jointed, the basal joint being broad and flattened, the second of equal length in the form of a strong claw, with a plumose appendage at its base.

* 'Bidrag til Kundskab,' 1863, pp. 217-219.

Mouth-organs are much the same as *B. megaceros*, *B. tricer*os, &c., but between the basal joints of the first peræopods is seen an oval cavity with a ciliate margin.

First peræopod with a strong basal joint bearing two branches, the outer two-jointed, the inner three-jointed, carrying plumose hairs.

Second, third, and fourth peræopods two-branched, each with three joints, the outer of irregular shape, from the outer border of which spring short claws, on the upperside of these one sees five to seven very strong teeth, and at the end a short spur; the terminal joints and inner borders have plumose hairs as usual.

Fifth peræopod single-branched, three-jointed, terminating in three simple hairs, the middle being the longest; there is also a fine hair placed halfway up this joint.

Genital segment and caudal joints one third the total length, slender and tapering, four in number, each joint wider than long; the terminal joint bears two elongated caudal plates, giving off from the end one very long and one short bristle; also a minute hair on the outer side.

Egg-sacs very large, as long as the whole animal; eggs round, three in the diameter of sac.

Length 3-4 millim.

Caligidæ.

HERMILIUS, Hell.

Hermilius longicornis, sp. n. (Pl. III. fig. 2.)

This is the second known species of this genus, which was formed by Dr. Heller in describing an animal with a peculiar bivalve-shaped cephalothorax*. His specimens were found on the gills of a "cat-fish" (*Arius acuta*), Java; mine were taken in quantity from the gills of another "cat-fish" (*Arius acutirostris*) at Trincomalee. From almost all the fish examined some specimens were obtained, the parasite being very abundant; it firmly clasps the gills with its folding-up cephalothorax, being anchored by the strong hooks of the second antennæ; on examining the fish only the egg-sacs are visible, their light colour causing them to be easily detected.

This species is readily separated from *H. pyriventris*, Hell., by the great size of the posterior antennæ and by the oblong form of the genital segment.

* 'Crustaceen: Reise der Fregatte Novara,' 1865.

Female.—The *cephalothorax* being folded up as a mussel is deeply notched in front and behind, the length of each valve is much greater than the breadth, and equals about two fifths of the total length; it has a rounded, somewhat lobed border, and fringing the margin is a wide band of lineate structure, which on higher magnification is seen to be due to minute parallel canals, and no doubt assists in the holding power of the valve; on the dorsal surface the chitinous ribs are seen as described by Heller.

Frontal plate narrow, with a straight border, from the outer and under side of which rises the *anterior antennæ*; these are small, two-jointed, the basal being longer than the second, having on its front border about ten ciliated setæ; the second joint is rod-shaped, terminating in a few fine bristles.

Posterior antennæ placed some distance back from the frontal border; they are very long and strong, the claw-like ends projecting well in front of the anterior border; each is composed of three joints—the basal is short, thick, and muscular, carrying a small sharp-pointed spur directed backwards, as in many of the "*Caligidæ*"; the second joint is short and thick, bearing the long terminal claw-joint on a firm articulation; it is widely curved, sharp-pointed, and has on its concave border one third from the point a secondary sharp hook, rather less long, but not articulate.

Rostrum of moderate size, three times as long as broad, tapering to the point.

First maxilliped very small, two-jointed, with a sharp-pointed palp near its base.

Second maxilliped very long, two jointed, the first being oval and muscular, the second slender, curved, chitinous, terminating in a short sickle-shaped point, with a minute tooth at its base.

Furcula very small, with a short dilated base, bearing straight, pointed, slightly divergent branches; the distance between the points equals the length of the branch.

First peræopod three-jointed, the basal short and thick, with a small lobe from the inferior border; the second joint is about twice as long, the third is short, bearing on the under border three long plumose hairs; at the extremity are seen three long straight bristles, the upper being the longest, equalling the whole length of the limb; at the angle is a very short bristle.

Second peræopod of the usual form; *third* as in "*Caligus*"; the two branches are here placed close together and are very

small; the *hamulus* is very small, slightly curved, and just overlaps the border.

Fourth pereopod very short, not reaching as far as the border of the genital segment; it terminates in three short simple hairs, with a fourth halfway down the lower border.

Genital segment large, oblong, lobed posteriorly, slightly narrower in front.

Abdomen small, as broad as long, about one sixth the length of the genital segment. Caudal plates longer than broad, bearing three short terminal *plumose* setæ and two short hairs on the outer border.

Egg-sacs long, as in *Caligus*.

Length 5 millim.

CALIGUS, Müll.

Caligus arii, sp. n. (Pl. IV. fig. 1.)

This species was found in greater or smaller numbers on every example of a "cat-fish" (*Arius acutirostris*) examined at Trincomalee, Ceylon. During the month of October 1897 both sexes were present in various stages of maturity, and appear never to attain any considerable size: during life they were very active; the "lunulæ" were very marked, projecting in front of the frontal border, the carapace markedly vaulted, and colour quite transparent, without spots; the posterior lobes of the genital segments in the immature females were strongly marked.

These animals were taken in company with *Hermilius longicornis* and *Lepeophtheirus longipalpus* on the inside of the operculum and on the roof of the mouth. This species seems to be nearest allied to *C. monacanthi*, Kr., taken in the West Indies, differing, however, entirely in the details of the swimming-feet, caudal plates, &c.

In the female the *cephalothorax* was almost circular in shape, slightly longer than broad, considerably shorter than the remaining portion of the animal, narrowing rapidly anteriorly; the posterior central lobe, which is broad, is separated from the posterior lateral angles by a deep cleft, the whole being strongly arched upwards and having the outer circular edge bordered with a strip of very fine short parallel tubes. Frontal plates of moderate size, somewhat indented in the centre. Lunulæ very large and prominent.

Anterior antennæ: first joint equal in length with breadth of lunule, bearing about twenty small plumose hairs; second joint club-shaped, with fine terminal hairs.

Posterior antennæ placed well to the outer side of the

rostrum, large, three-jointed, the terminal joint being unusually long, with oblique curved claw.

No *hamulus* detected.

First maxilliped of the usual form. *Mandible* slender, with the last third of the concave border strongly dentate. *Palp* short, sharp, slightly curved.

Second maxilliped: basal joint short and thick, the second a short curved simple claw, bearing a minute hair on the concave border one third from the point; this means of attachment is peculiarly small compared with that of the strong posterior antennæ. *Furcula* very prominent and strong; the base is broad, with straight sides, bearing large, divergent, simple branches with blunted ends, the width of the opening being equal to the length of the arms. The first of the swimming-feet (*peræopoda*) has from the short basal joint a long plumose hair equal in length to that of the second joint; the third joint or palm bears three short hooked claws on its outer end of about the same length, a fine slender hair at the angle, and three long plumose hairs from the under edge. *Second peræopod* of usual character, the third is peculiar; the *hamulus* is distinctly two-jointed, the spur being almost straight, not projecting beyond the border of the first joint of the outer branch; these two articulate branches are placed close together and are very large, the surface of the terminal joints being finely granular; the outer bears seven and the inner six plumose hairs. *Fourth peræopod* of moderate size, four-jointed, the three claws of the terminal joint and that of the penultimate being placed close together, of nearly equal length, a fifth being placed higher up; the last joint of the cephalothorax, from which these spring, is elongated and of a diamond shape.

Genital segment oblong, with a rounded anterior border and strongly lobed posterior angles, from between which rises the extremely elongated abdominal segment; this is biarticulate, the second joint being very short, its breadth equal to its length, its posterior border giving off two minute sessile caudal plates, which are broader than long; there are three terminal plumose setæ, two minute ones on the outer side, and a single one on the inner.

Length 5-6 millim.

Caligus platytarsis, sp. n. (Pl. IV. fig. 2.)

This animal was obtained in great numbers on a species of *Mugil* at Muscat, found in the gill-cavity; only females, more or less mature, were taken.

This species is remarkably characteristic in form by its rounded carapace, squarely cut genital segment, bearing at the angle the fifth peræopods, and elongated abdomen, the whole being spotted with pink; the form of the furcula and fourth peræopods are quite distinct, separating it from *C. isonyx*, Steen. & Lütke*, to which species it bears a resemblance; these authors lay great stress on the excavated condition of the front border of the frontal plate, and the secondary spur on the palp, which are not present in this species; their specimens were taken on a *Sphyræna* in the West Indies.

Female.—*Cephalothorax* rounded, as broad as long; frontal plates narrow. Lunulæ very shallow. *Anterior antennæ*: first joint twice as long as the breadth of the lunule, the front border provided with about fourteen fine plumose hairs, the second joint is rather short and slender, with fine hairs at the end. *First maxilliped* of the usual form, the second of moderate size, the terminal claw without hair on the concave border. *Hamulus anterior* not detected. *Furcula* quite peculiar, rising from a broad base; instead of ending in the usual elongated branches, there appear to be two thickened knob-like processes; this condition was found in all the specimens, and therefore was not due to fracture. I have not met with this condition in any other species. *First peræopod*: the basal joint bears a small lobe on the lower border, the second has a minute spur on the outer extremity, and the third carries three claws at the extremity of nearly equal length and three long plumose setæ from under border. *Second peræopod*: the first and second joints of the outer branch each carry a small spur-like claw on the upper border, the third or terminal has three of smaller size, with six long feathered hairs beneath; the inner branch is three-jointed as usual. *Third peræopod* has the paddle-branches placed some distance apart; the outer border of the second joint of the outer branch bearing three short simple hairs, the inner border four long plumose ones. *Hamulus* small and almost straight. *Fourth peræopod* of moderate length, four-jointed, the last three joints as usual welded together, terminating in a minute spur; the last joint carries on the outer side a moderately strong sharp simple claw, placed close to it equally distant from one another are four flattened "toes," covered with minute hairs like the tongue of a fly—two rising from the last joint, one from the third, and one from the second.

Genital segment flask-shaped, the posterior border cut off

* 'Bidrag til Kundskab,' 1861, pp. 18-19.

quite squarely with the abdomen; at the outer angle on either side one sees a small process carrying three fine hairs (rudimentary fifth peræopods), also a longer one placed just internal to it. *Abdomen* single-jointed, long, equal in length to that of the last segment of the cephalothorax and the genital one. *Caudal plates* much longer than broad, on a narrow base, carrying three long plumose hairs posteriorly—a shorter one on the inner border and two minute ones on the outer.

Length 6 millim.

Caligus Cossackii, sp. n. (Pl. IV. fig. 3.)

This species was taken from the gill-cavities of *Chrysophrys sarba* at Bunder Abbas, in the Persian Gulf, in some quantity, both sexes; the male had also been taken before from the same fish at Colombo, together with a second undetermined species and *Lernanthropus atrox*.

These were very active, living for some time in a glass tube, showing great fondness for creeping up the glass out of the water, as Dana described, when they were with difficulty dislodged, at other times swimming briskly about; during life the genital segment showed a very corrugated edge and the intestine was clearly seen to pass down to the extremity of the abdomen between the caudal plates.

This species bears a considerable resemblance to *C. productus* of Steen. & Lütke., which varies considerably from the *C. productus* of Krøyer*, but is differentiated from them both by the character of the hamulus anterior, first peræopods, and by the caudal plates, &c.

Female.—*Cephalothorax* oval, much longer than broad, equal to one half the total length; frontal plate deeply excavated in the centre, having on the outer portion the very large and prominent lunulæ which extend to the back border of the plate. *Anterior antennæ*: first joint not quite so long as the breadth of the lunule; it is provided with about seventeen plumose hairs, these being longest at the outer end; second joint of moderate length. *Posterior antennæ* terminating in a very slender hook. *Hamulus anterior* very large, with a widely dilated base and a strongly recurved blunt hook. *First maxilliped* of usual form, the second having a short thick basal joint and a moderately large terminal claw with a minute hair on the concave border.

Furcula with a narrow base, giving off two pointed divergent branches, which again approach towards the extremity,

* 'Bidrag til Kundskab,' 1863, pp. 64-66.

the width of the opening being less than the length of the branch. *First peræopod*: the palm-joint is provided with three small simple claws of equal length; a fine hair at the angle and three long plumose setæ from the under border. *Third peræopod* carrying the two branches some distance apart, the first joint of the outer branch having on the outer side a single short spur, the second having three, with four plumose hairs on the inner border. *Hamulus* small, claw slightly bent. *Fourth peræopod* three-jointed, bearing at the extremity three curved simple claws, the outer being slightly the longest; on the centre of the inner border is a fourth, and from the end of the penultimate joint a fifth slightly shorter.

The *genital segment* is elongated, narrowing gradually anteriorly, broadest in the centre, slightly narrower and rounded posteriorly. *Abdomen* rather long, equal to the length of the last segment, divided into two parts, more or less well marked, of about equal lengths.

Caudal plates longer than broad, bearing three terminal plumose hairs and a smaller one on the outer border.

Length 5 millim.

Male.—Differs in its much more elongate form and oval genital segment; the terminal hook of the posterior antennæ is very small, but that of the hamulus anterior is very long and strong; the basal joint of the second maxilliped carries on the inner border a double-crowned tubercle, to which the point of the second joint approximates; the caudal plates are longer and profusely ciliated.

Length 3 millim.

The species described by Heller as *C. constrictus* is evidently a male, being very like this; but he states "the lunulæ are minute."

LEPEOPHTHEIRUS.

Lepeophtheirus rotundiventris, sp. n. (Pl. V. fig. 1.)

A single female specimen of this species was obtained from the gill-cavity of a species of *Lutjanus* at Colombo; a male was found on a *Serranus* at Muscat: though not taken at the same time, place, or on the same host, yet the occurrence of the distinctive characters in both of them, especially that of the fourth peræopod, justify me, I believe, in placing them in one and the same species. There is a resemblance of this animal to *C. brachyurus*, Hell., taken at Java, but they differ in important details; the peculiarly rounded genital segment and the very large last thoracic joint of this species at once draw the attention of the observer.

Female.—Carapace as broad as long, narrowing rapidly in front, where is seen the rather deep frontal plate, excavated considerably in the middle.

Anterior antennæ: first joint short and thick, with many plumose hairs on the anterior border; the second much longer, cylindrical, with a tuft of hairs at the end and one near the middle of the lower border. *Posterior antennæ* of moderate size. *Hamulus* has a rather dilated base, with short curved claw. *Palp* with two slightly divergent branches, both sharply pointed, the inner being the longer. *Maxillipeds* not remarkable. *Furcula* small, with very short, pointed, slightly divergent, simple branches, the base strong and broad, on either side having a double root.

First peræopod: the basal joint is short, the second cylindrical, and the palm bears three short end-claws, a long bristle at the angle, and three long plumose hairs from the lower border.

Second peræopod: the upper border of the first two joints of the outer branch bears each a single short spur, the third or last joint has two.

Third peræopod: the lamellar plate is large, the branches are placed close to one another, but not overlapping.

Hamulus posterior of moderate size, claw slightly bent. Last thoracic segment very large.

Fourth peræopods long and strong, distinctive of the species, consisting of four joints: the first long, cylindrical, and muscular; second to fourth fused, long, narrow, with parallel borders, the under being finely ciliated; from the last joint are three long curved hook-claws, the outer being much the longest, from the third joint a fourth, but less long, and from the second an extremely short one is visible.

Genital segment almost a perfect sphere; near the posterior edge are seen the rudiments of the fifth feet in the shape of a small tubercle with three hairs from it. Abdomen very short, one quarter the length of the genital segment, single-jointed, broadest near the centre, narrowing posteriorly. Caudal plates small, broader than long, with three terminal plumose hairs, and a shorter one on the outer border.

Length 4-5 millim.

Male.—*Cephalothorax* large, more than two thirds the length of the whole, oval, widest posteriorly, last thoracic joint not so large as in the female. *Genital segment* deeply excavated behind, causing the appearance of two lobe-like prolongations, each of these terminating in a long papilla, ending in a strong bristle, with two smaller ones on the inner border.

Abdomen near its termination broadens considerably, the caudal plates being widely separated. The *posterior antennæ* are of great size, the terminal hook extending nearly to the edge of the carapace; but the hamulus anterior is not proportionately increased. The other parts are as in the female.

Length 5-6 millim.

Lepeophtheirus longipalpus, sp. n. (Pl. V. fig. 2.)

A single well-grown female specimen of this species was obtained from the gills of *Arius acutirostris* at Trincomalee, with *Hermilius longicornis* and *Caligus arii*; the species is distinctly characterized by the peculiar structure of the maxillary palps and that of the fourth pair of legs.

Cephalothorax robust, a long oval; posterior lateral angles obtusely rounded; last thoracic segment well marked, diamond-shaped, with a secondary lobe at the juncture with the genital segment; the frontal plates are long, with a straight border, having a deep notch in the centre.

Anterior antennæ small, basal joint carrying about seventeen fine plumose hairs; second joint of equal length, with a terminal tuft.

Posterior antennæ: the first joint bears a strong spur directed backwards; the last joint long, forming a strongly bent claw.

Mandible of the usual form. *Palp* rising from below the base of the posterior antennæ, and inside the first foot-jaw is in the form of a long blunt curved horn directed inwards and backwards towards its fellow, and reaching almost as far as the furcula; this condition is quite peculiar, destroying a point which one had looked upon as almost of generic value, viz. the bifid palp.

Maxillipeds of the usual form. *Furcula* large, prominent, base broad, with slightly spreading roots; branches long, almost parallel to one another, blunted at the extremities, the width of the opening being about equal to two thirds the length of the branches.

First peræopod with a short basal joint, bearing a lobe on the under border; the palm with three minute terminal claws and three long plumose setæ from the under border.

Second peræopod of the usual form, but the upper border of each joint of the outer branch carries a single claw, the outer one being the longest.

Third peræopod: the two branches are placed close together, each distinctly two-jointed, the terminal joint of the outer carrying six hairs, short, but progressively increasing

in length from without inwards; the first joint of the inner branch has one, the second six short hairs. Hamulus very small.

Fourth peræopod of considerable size and robust form, consisting of four joints, the last terminating in a minute spur, close to which are placed three end-claws, two others being placed at the inner end of the second and third joints; each of these five is seen to have a minutely crenate edge, which on higher magnification shows a beautifully serrated border, transversely striated; an abortive fifth limb is found at the angle of the genital segment in the form of a small tubercle, giving rise to three short plumose hairs.

Genital segment oval, with a truncated posterior border; equals half the length of the cephalothorax.

Abdomen elongated, as long as the last segment, consisting of a prolonged first joint and a second of a square form.

Caudal plates small, slightly longer than broad, with three long terminal plumose hairs and two minute ones on the outer border.

Length 6-7 millin.

ANURETES, Hell.

Anuretes perplexus, sp. n. (Pl. V. fig. 3.)

This genus was formed by Heller, and has been retained by Gerstaecker, the original specimen having been described by Krøyer as *Lepeophtheirus Heckelii*; it is distinguished by "the entire deficiency of separate tail-segments," all other parts agreeing with the genus *Lepeophtheirus*. The first specimen was obtained from *Ephippus gigas* in the Brazilian sea, described by "Koller" as *Caligus Heckelii*, being preserved in the Vienna Museum. A second specimen was taken from the same species of fish off New Orleans by Krøyer; he states that "this species has a moderately wide diffusion." I have been fortunate enough in a far removed locality—namely at Trincomalee, Ceylon—to find on a species of *Lutjanus* about a dozen specimens of a second form of this peculiar animal, though the necessity for making for it a distinct genus seems to me rather doubtful, for in some the position of the caudal plates is as Krøyer describes, but in a few these project a little beyond the posterior edge of the genital segment, though in none does "the abdomen appear drawn out."

Female. — *Cephalothorax* rather broader than long, narrowing in front; the posterior lateral angles obtuse, not

reaching so far backwards as the middle lobe; the frontal plate is narrow, convex forward, with a shallow median notch.

Anterior antennæ equal in length to half the frontal plate, of the usual form.

Posterior antennæ three-jointed, the basal with a well-marked sharp spur directed backwards, the end claw of moderate size. *Hamulus anterior* in the form of a very minute hook, with a dilated base, placed well towards the border near the extremity of the posterior antennæ. *Rostrum* not of unusual length (as in *A. Heckelii*), but less broad than long; the palp is simple, slender, sharp-pointed, and slightly curved, placed near the base of the first foot-jaw and the trunk, the point reaching a little in front of the latter.

First maxilliped of the usual form, but near the middle of the convex border of the second joint a minute hair is seen. *Second maxilliped* quite distinctive, forming a very powerful holding-organ, the basal joint being thick and muscular, having at the inner end of the concave border a strong triangular process, against which the large claw-like second joint is opposable; on the inner margin of the latter near the base is a strong bristle. *Furcula* very small, the branches being short, thick, and almost parallel; their length equals the breadth between the points.

First peræopod: first joint short, the second long, the lower border fringed with fine hairs, the palmar carrying at the end three hook-like hairs, the upper being the longest; at the angle there is a long fine bristle, on the inferior border three long plumose hairs of the usual form. Second of the usual form: the third has, on the large flap-like basal joint, the two small articulate branches placed close together at the edge, but not overlapping one another; they are of small size. The hamulus is small, but well-marked, the claw being almost straight. *Fourth peræopod* three-jointed, at the extremity of the last joint are three slightly curved claws, placed close together, of nearly equal length; at the juncture of the second and third joints is a fourth claw.

Genital segment about two thirds the length of the cephalothorax, almost round in outline, except for being cut away in the middle line posteriorly, forming there a shallow triangular depression; on the posterior border outside of this is seen a very prominent plate projecting beyond the genital segment, carrying three long plumose hairs terminally and one on the outer border—these are the fifth peræopods; there is also a strong bristle from the genital segment, external to these; rising from the under surface of the genital segment, in the middle line, are the true *caudal plates*, which are short,

giving off four plumose hairs, the second from the inside being very long, always projecting beyond the border. These caudal plates are sometimes quite hidden, at others they are just visible beyond the border; between them are two small bilobed tubercles, divided from one another by the extremity of the alimentary tube.

Egg-sacs as in *Caligus*, often long.

Length 3 millim.

Dichelesthina.

LERNANTHROPUS, Nordm.

Lernanthropus atrox, Hell. (Pl. VI. fig. 3.)

At Bunder Abbas, in the Persian Gulf, attached to the gills of *Chrysophorys sarba*, a large number of specimens, both male and female, of a *Lernanthropus* were taken, the female so closely resembling *L. atrox* described by Heller, taken from a "*Pagrus*" in Australian waters, that I have felt justified in coming to the conclusion that they are the same, though in the one described by him the anterior antennæ are stated to be two-jointed only, which, though it may be presumptuous to say, as I have done in my last paper*, is probably due to an error of observation on his part, as invariably in my experience, and from descriptions and plates of Kröyer and Beneden, the anterior antennæ have at least six joints—a generic guide. As the unnecessary multiplication of species is to be deplored, I have referred my specimens to this species, giving here a representation of the animal as seen from the back and side, also a more enlarged drawing of the antennæ, as well as of the newly found male.

Female.—*Anterior antennæ* seven-jointed, the fourth joint being the longest, bearing a small lobe-like process from the lower border, the joints decreasing in size to the last, which carries a bundle of fine hairs.

Posterior antennæ with a long muscular basal joint and a strong terminal hook.

Length 4 millim.

Male.—Caput oblong in shape, cut off squarely in front; side margins infolding equally, about one third the length of the whole excluding the caudal processes.

Anterior antennæ seven-jointed, as in the female.

Posterior antennæ with very strong, curved, grasping-hooks, which project far beyond the cephalic border.

Rostrum pointed, but short; on either side are seen the

* Ann. & Mag. Nat. Hist., Jan. 1898, p. 2.

minute mouth-organs, a slender mandible, straight and sharp-pointed; outside this is the maxillary palp, with a thickened base, and a cylindrical second joint, ending in two short blunt hairs, the outer being much the shorter.

First maxilliped placed close behind the rostrum; it is two-jointed, the first extending to near the border of the head, muscular, the second a slender curved claw, having the concave border near the point markedly serrated.

Second maxilliped equal in size to that of the first, but having the terminal point simple.

First pair of thoracic feet minute, placed close under the cephalic border, two-branched, springing from a broad thickened basal plate, the outer branch bearing five short thick hairs, the inner branch more slender, terminating in a single long bristle. The second pair are placed a little posterior to the first and of like structure, the outer branch having, however, only three short hairs.

Genital segment an elongated oval shape, giving off on either side two pairs of lancinate foliaceous processes, equalling in length two thirds that of the whole animal.

Abdomen short, rounded, broader than long. Caudal plates simple, lancinate.

Length 3 millim., excluding processes.

PSEUDOCLOVELLA, gen. nov.

Body elongate, without dorsal plates or lateral processes; head obtusely rounded. Anterior antennæ setaceous, indistinctly three-jointed. Posterior antennæ two-jointed, terminating in a powerful simple hook. First maxilliped minute, three-jointed. Second maxilliped two-jointed, long, projecting beyond the cephalic margin. Thorax showing one distinct segment dorsally. Four pairs of limbs are present, the first and second biramous, the third and fourth from the genital segment minute, papilliform; genital segment four times as long as head and thorax. Abdomen short, caudal plates lamellar. Egg-tubes long, ovules flattened.

This genus may be known by its single free thoracic segment, by the absence of any lateral plates, by the presence of two pairs of well-formed thoracic limbs, by the oval genital segment, from the sides of which rise the third and fourth pair, stump-like and rudimentary, by the setaceous indistinctly jointed anterior antennæ, and by the long slender second maxillipeds. It has a near relationship to *Clavella*, "Oken"; but in all cases the presence of four pairs of limbs was found (though easily shrivelled up and overlooked in

mounted specimens), the thorax only shows as one ring, the genital segment is proportionately much shorter, and the anterior antennæ, though setaceous, appear to be only tri-articulate.

Gerstaecker separates the *Dichelesthina* thus :—

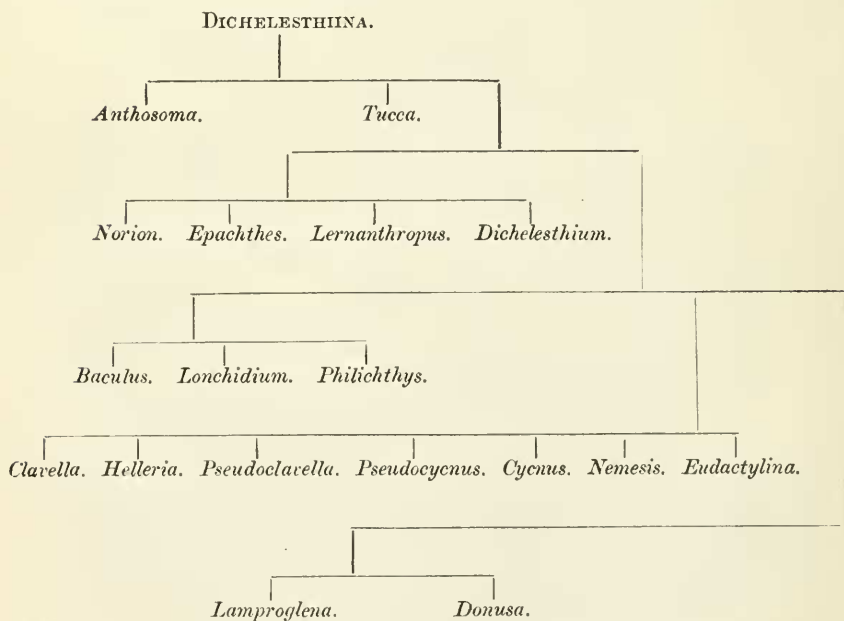
- A. Abdomen with two large dorsal plates *Anthosoma*, Leach.
- B. Abdomen without dorsal plates.
 - a. Ambulatory leg suppressed *Tucca*, Kr.
 - b. Posterior legs or all changed into lamellar plates *Norion*, Nordm.
Epachthes, Nordm.
Lernanthropus, Nordm.
Dichelesthium, Herm.
 - c. Posterior legs neither bigger than front nor lamellar.
 - a'. Posterior antennæ with cheliform end-claw.
 - a''. All four pairs of limbs 2-branched.
 - a'''. Anterior antennæ 8-jointed *Lonchidium*, Gerst.
 - b'''. Anterior antennæ 4-jointed *Baculus*, Lubb.
 - b''. Only two first pairs 2-branched *Philichthys*, Stp.
 - b'. Posterior antennæ with single end-claw.
 - a''. Anterior antennæ single, posterior projecting.
 - a'''. Only two pairs of limbs formed; genital segment five or six times as long as head and thorax; anterior antennæ 6-jointed. *Clavella*, Oken.
 - b'''. All four pairs of limbs formed.
 - a⁴. Anterior antennæ 15-jointed; second to fourth legs 2-branched, 1-jointed *Nemesis*, Roux.
 - b⁴. Anterior antennæ 6-jointed; all limbs 2-branched *Cycnus*, Edw.
 - c⁴. Anterior antennæ 3-jointed; only second pair 2-branched, the others stump-like. *Pseudocycnus*, Hell.
 - b''. Anterior antennæ with hooked basal joint; the posterior short, with three claws *Eudactylina*, Bened.
 - c'. Posterior antennæ without end-claw; the point provided with hairs.
 - a''. Anterior antennæ 10-jointed; true legs single-jointed *Lamproglena*, Nordm.
 - b''. Anterior antennæ 5-jointed; true legs 3-jointed *Donusa*, Nordm.

In accordance with the two new genera which I have described, the classification of the latter portion has to be somewhat altered, as follows :—

- b'. Posterior antennæ with single end-claw.
- a''. Anterior antennæ single, posterior projecting.
- a'''. Only the two anterior pairs of limbs formed; genital segment

- five or six times as long as head and thorax; anterior antennæ 6-jointed *Clavella*, Oken.
- b'''*. Only three pairs of limbs formed, first biramose, second uniramose, third stump-like; anterior antennæ 6-jointed *Helleria*, B.-S.*
- c'''*. All four pairs of limbs formed.
- a*⁴. Anterior antennæ 3-jointed; first and second pairs of legs biramose, third and fourth stump-like; genital segment four times as long as head and thorax *Pseudoclavella*, g. n.
- b*⁴. Anterior antennæ 6-jointed; all four pairs of legs biramose *Cycnus*, Edw.
- c*⁴. Anterior antennæ 15-jointed; second, third, and fourth legs biramose, 1-jointed, first uniramose *Nemesis*, Roux.
- b''*. Anterior antennæ with hooked basal joint; posterior antennæ short, with three claws *Eudactylina*, Bened.

Expressed diagrammatically, thus :—



* Ann. & Mag. Nat. Hist., Jan. 1898. p. 10.

Pseudoclavella ovalis, sp. n. (Pl. VI. fig. 1.)

The gills of a *Serranus*, sp., captured at Muscat, were found to be crowded with these small parasites, which held very firmly on to the delicate margins of the gills by their strong posterior antennæ; the long dark-coloured ovarian tubes projecting considerably outwards made their detection easy; altogether there were hundreds of them in the one fish.

Female.—Caput of an oval shape, with a slight central lobe anteriorly, and somewhat broadened behind, where it unites with the single free thoracic segment, which is broader than long. The genital segment is of an elongated oval shape, robust in form, about four times as long as the cephalothorax. Abdominal segment small, broader than long, giving off two foliate caudal plates, each bearing three short, fine, terminal hairs and a fourth of smaller size on the outer border; on each side of the abdominal tubercle are seen the comparatively large egg-tubes filled with large flattened ovules in a single row.

Anterior antennæ rise from the head a little behind the anterior border; they appear to be three-jointed, but the divisions are very indistinct; from the basal joint, which is long and thickened, rise two pairs of short strong hairs on the front border; from the second, which is shorter, there are two short hairs above and one below; the last joint, which is longer, bears two short hairs near the base, one above and one below; a very long, strong, deeply rooted one on the upper border near the middle, with a tuft of smaller terminal bristles.

Posterior antennæ placed a little further back; it is two-jointed, the first being broad and stout, the second in the form of a strong, short, recurved, claw, with a thickened tuberculate base; this does not project beyond the cephalic border.

Rostrum short, blunt. *Pulp* very minute, slender, straight. Outside this is seen a very small representative of the *first maxilliped*; it is three-jointed, the terminal joint in the form of a claw.

Second maxilliped large, the extremity of the basal joint projecting well beyond the border of the head; the second joint is very slender, longer than the basal, terminating in a curved sharp point.

Rising from the posterior border of the carapace on either side underneath are seen the first pair of thoracic limbs; there is a broad basal joint, giving off two small branches, the inner is single-jointed, terminating in two hairs, the outer

consists of two joints, the first having a minute hair on the outer side, the last with three small terminal ones. Placed a little more backward on the posterior outer angle of the thoracic segment are found the second pair of limbs, more distinctly visible than the first, being larger, the basal joint being strongly lobed, giving off two branches, each of two small joints, ending with a strong bristle. The next two limbs are rudimentary, the third being placed about one third down the side of the genital segment, in the form of an elongated tubercle terminating in three simple bristles. Two thirds down is seen the fourth pair of like character, but rather smaller.

Length 3 millim.

Lernæopodidæ.

BRACHIELLA, Cuv.

Brachiella multifimbriata, sp. n. (Pl. VI. fig. 2.)

This animal does not appear to correspond with any yet described; in outward form it is so characteristic, I venture here to describe it as a new species.

On a large *Serranus* at Muscat I found one of these attached to the inside of the operculum; but on opening the mouth the lips, tongue, palate, and cheeks were seen to be thickly studded with them, especially the inner fold of the lower lip; they were attached so firmly that the mucous membrane had to be cut away with them. Afterwards on careful examination of these I was disappointed to find only one pigmy male; this minute creature was hooked on to the cephalic portion of a female, as shown in Pl. VI. fig. 2*a*. I only succeeded in making a rough drawing of this, unfortunately losing the specimen while preparing it for mounting; it shows, however, distinctly the *Brachiella* form.

Female.—Colour pale, translucent, except for the ovaries and ovarian sacs, which are opaque white. Head and neck generally recurved forwards, equal very nearly in length to that of the genital segment. Arms of attachment (second maxillipeds) placed close to the latter, distinctly separated from one another in the middle portion, not quite equal in length to the neck; organ of adhesion a sucking-disk (as distinct from the drill usually found in *Anchorella*).

Genital segment: this from the back appears as an irregular elongated hexagon with concave sides, giving off from each of the two lateral points four filiform semitransparent processes; from the posterior angle on each side of a short

abdominal tubercle are two more processes, the dorsal being the longer.

Genital sac full of large round eggs.

Length about 7 millim. without processes.

Male minute, about 1 millim. long (Pl. VI. fig. 2 e).

Cephalothorax oval, distinctly divided off from the segmented caudal portion, which appears to consist of three joints, terminating in two lancinate plates.

Anterior antennæ placed close to the posterior, which spring from the upper and anterior border of the cephalothorax; the first is three-jointed, ending in three short hairs; the posterior has a thickened basal joint and a short square second, also terminating in three hairs.

First maxillipeds very large and strong, the root-joint very muscular, its upper border being much lobed; the claw is very strongly bent, thick at the base, and sharp at the point, with a short curved tooth about the centre of the concave border.

EXPLANATION OF THE PLATES.

PLATE III.

Fig. 1. *Bomolochus denticulatus*, ♀, sp. n., from the back, magnified.

1 a. Seen from the side. 1 b. Hamulus anterior. 1 c. Terminal joint of posterior antennæ. 1 d, e, f, g, h. First to fifth peræopods. 1 i. Last two joints of abdomen and caudal plates. 1 k. Spur on outer side of outer branch of peræopod, showing dentation, highly magnified.

Fig. 2. *Hermilichus longicornis*, ♀, sp. n., from back, magnified.

2 a. Seen from the side, with valves closed. 2 b. Carapace seen from beneath. 2 c. Anterior antennæ. 2 d. Terminal joint of first maxilliped. 2 e. Third peræopod, much magnified. 2 f. Last joint of fourth peræopod. 2 g. Abdomen and caudal plates.

PLATE IV.

Fig. 1. *Caligus arii*, ♀, sp. n., enlarged, seen from the back.

1 a. Carapace from underside, much magnified. 1 b. Third peræopod. 1 c. Fourth peræopod. 1 d. Abdomen and caudal plates.

Fig. 2. *Caligus platytarsis*, ♀, sp. n., enlarged, seen from back.

2 a. Fourth peræopod, hairy toe of same highly magnified. 2 c. Fifth peræopod. 2 d. Furcula. 2 e. Caudal plate.

Fig. 3. *Caligus cossackii*, ♀, sp. n., seen from the back.

3 a. Carapace from below. 3 b. Third peræopod. 3 c. Fourth peræopod. 3 d. Caudal plate. 3 e. Male, much enlarged. 3 f. Second maxilliped of the same.

PLATE V.

- Fig. 1. Lepeophtheirus rotundiventris*, ♀, sp. n., seen from the back.
 1 *a.* From beneath, much enlarged. 1 *b.* Terminal portion, with caudal plates. 1 *c.* Male.
- Fig. 2. Lepeophtheirus longipalpus*, ♀, sp. n., seen from back.
 2 *a.* Organs round the mouth. 2 *b, c.* Third and fourth peræopods. 2 *d.* Claw of fourth peræopod, much magnified. 2 *e.* Rudimentary fifth. 2 *f.* Caudal plate.
- Fig. 3. Anuretes perplexus*, ♀, sp. n., from the back.
 3 *a.* Cephalothorax from beneath. 3 *b, c.* Third and fourth peræopods, enlarged. 3 *d.* Terminal portion of genital segment, showing fifth peræopods and caudal plates. 3 *e.* The same in varied form.

PLATE VI.

- Fig. 1. Pseudoclavella ovalis*, gen. et sp. n.
 1 *a.* Seen from the back, much enlarged. 1 *b.* Side view of head and thorax. 1 *c.* Underside of cephalothorax. 1 *d, e, f, g.* First to fourth limbs.
- Fig. 2. Brachiella multifimbriata*, ♀, sp. n., seen from the back, with processes spread out.
 2 *a.* Same, seen from the side. 2 *b.* Fixing-organ of second maxilliped. 2 *c.* Under surface of head, much enlarged, showing organs. 2 *d.* Palp, more highly magnified. 2 *e.* Male, highly magnified. 2 *f.* A. 1 and A. 2 of the same. 2 *g.* Strong first maxilliped of the same.
- Fig. 3. Lernanthropus atrox*, ♀, Heller, seen from the back.
 3 *a.* Seen from the side. 3 *b.* Anterior and posterior antennæ of the same, much enlarged. 3 *c.* Male, enlarged, seen from below. 3 *d.* Mandible and maxillary palp. 3 *e, f.* First and second thoracic limbs.

N.B.—The line to the right of the figure gives the natural length of the animal.

XIV.—*The Species of Scorpions of the Genus Broteas.*

By R. I. POCCOCK.

ON page 173 of his recent 'Revision of Scorpions' Professor Kraepelin reduces the five species of *Broteas* that had been established to one, which he calls *maurus*, Herbst. As I have already pointed out, this name is, in my opinion, invalid; nevertheless the question of the name is of little importance as compared with the identity of the scorpions to which Prof. Kraepelin applies it. Being by no means satisfied as to the correctness of this author's synonymy, I wrote to M. Simon to beg for his types of *B. granulatus* and *B. paransis* and for an example of the species he considered to be